

**CLAIMS**

1. An intrinsically conducting polymer (ICP) blend obtainable by adding:
  - 5       a. a mixture of poly (3,5-ethylenedioxythiophene) and poly(4-styrenesulphonate) (i.e. PEDOT/PSS); to
  - b. a copolymer of vinylacetate and ethyleneto thereby form the intrinsically conducting polymer  
10       (ICP) blend.
2. An intrinsically conducting polymer (ICP) blend according to claim 1 wherein the viscosity of the PEDOT/PSS is about 60 to about 100 mPa.s.  
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3. An intrinsically conducting polymer (ICP) blend according to any of claims 1 or 2 wherein the amount of PSS present is in excess of the amount of PEDOT.
- 20   4. An intrinsically conducting polymer (ICP) according to any preceding claim wherein the ratio of PEDOT:PSS ranges from about 1:1.1 to about 1:5, from about 1:1.3 to about 1:2 or about 1:2.5.
- 25   5. An intrinsically conducting polymer (ICP) according to any preceding claim wherein the PEDOT/PSS is in a liquid form and has a concentration of about 1 - 2% by weight, about 1 - 10% by weight or about 3% by weight.
- 30   6. An intrinsically conducting polymer (ICP) according to any preceding claim wherein the PEDOT/PSS is dissolved in a solvent such as water.

7. An intrinsically conducting polymer (ICP) according to any preceding claim wherein the ratio of vinylacetate:ethylene is about 80:20.
- 5 8. An intrinsically conducting polymer (ICP) according to any preceding claim wherein the particle size of the vinylacetate:ethylene mixture is about 0.1 - 10 microns, 0.1 - 5 microns, 0.3 - 3.0 microns or about 0.3 - 1.2 microns.
- 10 9. An intrinsically conducting polymer (ICP) according to any preceding claim wherein the viscosity of the vinylacetate:ethylene copolymer is about 1,000 - 40,000 mPa.s, about 1 - 20,000 mPa.s, about 14,000 mPa.s or
- 15 about 2,500 mPa.s.
10. An intrinsically conducting polymer (ICP) according to any preceding claim wherein the vinylacetate:ethylene copolymer mixture is acidic and has a pH of about 2 - 6,
- 20 about 3 - 5 or about 4.25.
11. An intrinsically conducting polymer (ICP) according to any preceding claim wherein prior to mixing the PEDOT/PSS and the copolymer of vinylacetate and ethylene,
- 25 the PEDOT/PSS is mixed with an acid such as a carboxylic acid.
12. An intrinsically conducting polymer (ICP) according to claim 11 wherein the carboxylic acid is selected from
- 30 any C<sub>1</sub> - C<sub>20</sub> carboxylic acid, or combination thereof.
13. An intrinsically conducting polymer (ICP) according to claim 12 wherein the carboxylic acid is any of methanoic acid, ethanoic acid, propanoic acid, butanoic

acid, pentanoic acid, hexanoic acid, heptanoic acid and octanoic acid.

14. An intrinsically conducting polymer (ICP) according to any preceding claim wherein the ICP formed by mixing the PEDOT/PSS and the copolymer of vinylacetate and ethylene forms a substantially homogenous blend.

15. A coated product wherein the coated product comprises a substrate with a coating of an intrinsically conducting polymer (ICP) blend comprising PEDOT/PSS and a copolymer of vinylacetate and ethylene according to any of claims 1 to 14.

16. A coated product according to claim 15 wherein the coating is found to adhere strongly to the substrate, has good mechanical stability and is resistant to exfoliating.

17. A coated product according to any of claims 15 or 16 wherein the substrate is man made such as cellulose acetate, polypropylene, nylon or a biopolymer produced from renewable resources such as poly-lactic acid, poly-glycollic acid, or any copolymer thereof.

18. A coated product according to any of claims 15 to 17 wherein the coating has a thickness of about 0.001 to 0.5 mm, about 0.01 to 0.1 mm, or about 0.02, 0.03 and 0.04 mm.

19. A coated product according to any of claims 15 to 18 wherein the resistance of a coated part of the coated substrate may be about 0.1 to 500 k-ohm.

20. A coated product according to any of claims 15 to 19 wherein the coated substrate is treated with a metal salt solution dissolved in aqueous acid.
- 5 21. A coated product according to claim 20 wherein the metal salt solution is magnesium sulphate.
22. A coated product according to any of claims 20 or 21 wherein the concentration of the salt solution is about  
10 0.01 to 5 M, about 0.05 to 1 M or about 0.1 M.
23. A coated product according to claim 20 wherein the aqueous acid is a short chain carboxylic acid such as formic acid.
- 15 24. A coated product according to claim 23 wherein the volume ratio of the carboxylic acid such as formic acid and water is about 1:1 to 1:4.
- 20 25. A coated product according to any of claims 20 to 24 wherein the treated coated substrate is rinsed successively with water to remove excess salt, followed by ethanol and acetone.
- 25 26. A coated product according to any of claims 20 to 25 wherein treating the coated substrate with a metal salt solution dissolved in aqueous acid has the effect of 'fine tuning' the surface and decreases the surface resistance to about less than 5 k-ohms, less than 1 k-  
30 ohms or less than about 0.5 k-ohms.
27. A method of forming a coated substrate wherein coating material is formed by adding PEDOT/PSS to a copolymer of vinylacetate and ethylene to form an

intrinsically conducting polymer (ICP) blend according to any of claims 1 to 14 and depositing the intrinsically conductive polymer (ICP) blend onto a substrate.

5 28. A method according to claim 27 wherein the ICP blend is deposited by any suitable means such as spraying, brushing, or using a dropper such as a syringe.

10 29. An electrode comprising a coated substrate wherein the coating of the coated substrate is an intrinsically conducting polymer (ICP) blend comprising PEDOT/PSS and a copolymer of vinylacetate and ethylene according to any of claims 1 to 14.

15 30. Use of an electrode according to claim 29 in dental apparatus for the detection of caries.

20 31. Use of an electrode according to claim 29 as a thin, intermediate layer between an anode and a light emitting layer of organic polymers wherein the PEDOT/PSS copolymer blends polarise the otherwise rough ITO surface for subsequent organic layer deposition and increase the anode work function, thus facilitating hole injection.

25 32. Use according to claim 31, wherein the anode is indium-tin oxide (ITO).

30 33. Use of an intrinsically conducting polymer (ICP) blend according to any of claims 1 to 14 in forming conductive composite materials by depositing or impregnating the ICP blends onto natural or synthetic fabrics.

34. Use of an intrinsically conducting polymer (ICP) according to claim 33 in the formation of an electrode.

35. Dental apparatus for the detection of dental caries comprising:

at least one probe electrode comprising a coated substrate wherein the coating of the coated substrate is an intrinsically conducting polymer of PEDOT/PSS and a copolymer of vinylacetate and ethylene according to the first aspect, wherein the at least one probe is adapted to be placed in electrical contact with a surface of a patient's tooth;

a second electrode adapted to be placed in electrical contact with another part of the body of the patient;

an alternating current source adapted for passing an alternating electrical current between said at least one probe electrode and said second electrode;

impedance measurement means for measuring the electrical impedance between the at least one probe electrode and the second electrode to said electrical current;

wherein said alternating current source is a variable frequency alternating current source whereby the frequency of the alternating current applied to the tooth may be varied over a predetermined frequency range and the impedance measurement means is adapted to measure impedances corresponding to a plurality of frequency values within said range.

36. Dental apparatus according to claim 35, wherein by monitoring the impedance values, abnormalities in the detected signal are used to detect and locate dental caries.